Don't "Waste" Your Chance To Do Your Share

How To Reduce Your Climate Footprint

WASTE WISE

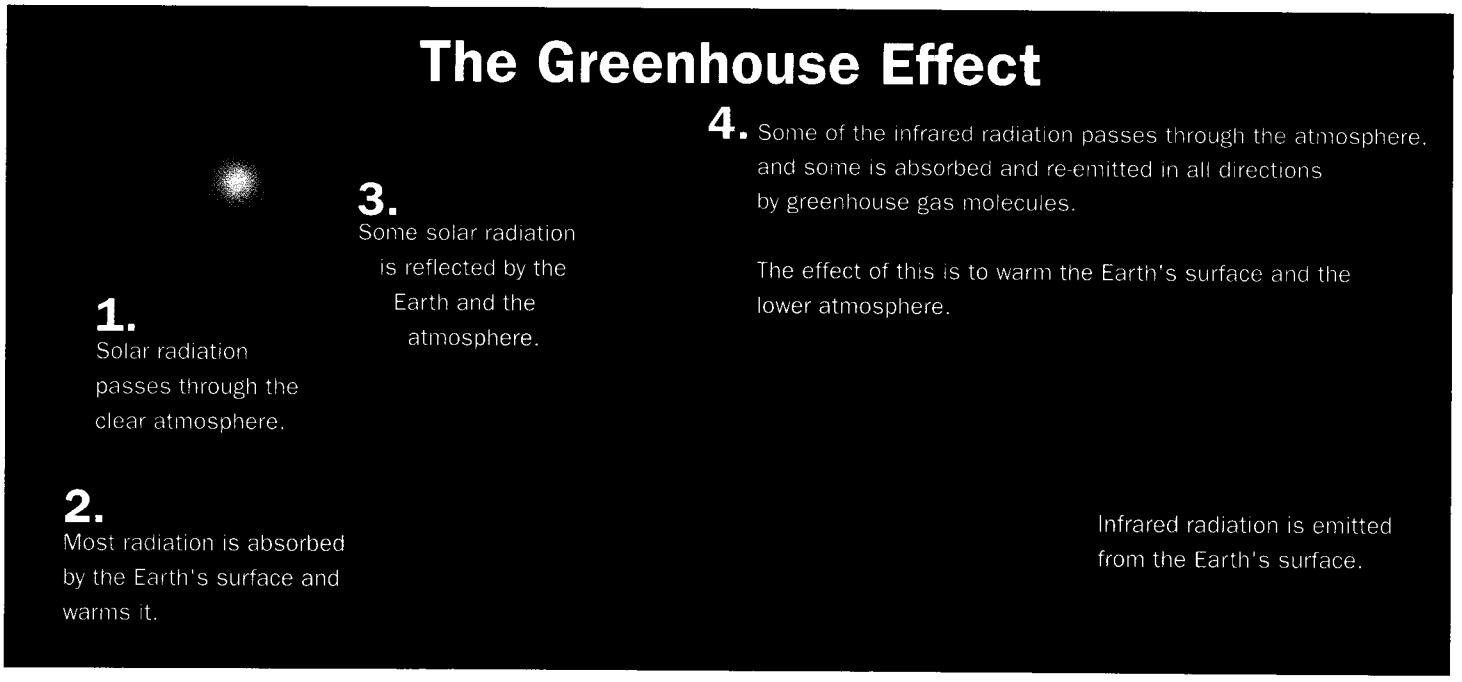
Climate Change and the Link Between Climate and Waste

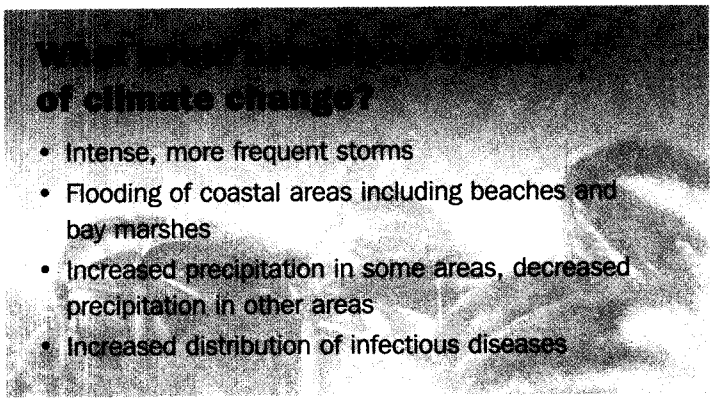
Greenhouse Gases and the Greenhouse Effect

Understanding the atmospheric phenomenon known as the greenhouse effect is critical to understanding global climate change. The Earth's atmosphere includes various gases—water vapor, carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O)—that collectively act as a greenhouse by preventing too much heat from escaping from the Earth's atmosphere and are therefore classified as greenhouse gases (GHGs). Other powerful GHGs that result from industrial processes and are not naturally occurring include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

GHGs are essential for regulating our climate because they absorb and hold heat from the sun in the atmosphere around the Earth. The climate control process begins with a wave of solar radiation passing through the atmosphere. Most of this radiation is absorbed by the Earth's surface, but some of the energy is reflected off the Earth's surface back into space as infrared radiation, which has a longer wavelength than solar radiation. Infrared waves can be trapped by GHGs, helping to keep the planet at a temperature suitable for life. Each GHG differs in its ability to absorb this heat. HFCs and PFCs are the most heat-absorbent. CH_4 traps approximately 23 times more heat per molecule than CO_2, and N_2O absorbs 270 times more heat per molecule than CO_2.

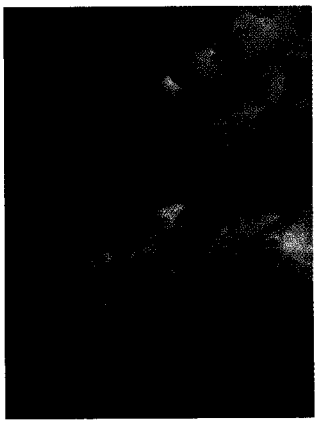
Without the atmospheric insulating effect provided by GHGs, the average temperature on Earth would be minus 2 degrees Fahrenheit, compared to the current average temperature of 60 degrees Fahrenheit. The average temperature, however, has increased by 1 degree Fahrenheit during the last century as a result of the recent increase in GHG concentrations in our atmosphere.





Climate Change—The Basics

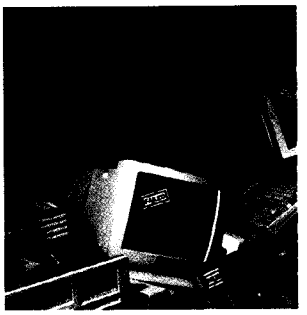
At one time, all climate changes occurred naturally. During the Industrial Revolution, however, humans began altering the climate and environment through changing agricultural and industrial practices. These activities have changed the composition of the Earth's atmosphere by increasing the levels of GHGs, primarily CO_2, CH_4, and N_2O. CO_2 is released to the atmosphere by the burning of fossil fuels, wood and wood products, and solid waste. CH_4 is emitted from the anaerobic decomposition of organic wastes in landfills; the raising of livestock; and the production and transport of coal, natural gas, and oil. N_2O is emitted during agricultural and industrial activities as well as during combustion of solid waste and fossil fuels.



The increased levels of GHGs in the Earth's atmosphere have the potential to cause global climate change. According to the National Academy of Sciences (NAS), the federal government's scientific advisory society, GHGs are accumulating in the Earth's atmosphere as a result of human activities, likely contributing to an increase in the global mean surface air temperature and subsurface ocean temperature. These temperature increases are problematic because human health, agriculture, water resources, forests, wildlife, and coastal areas are vulnerable to the changes that global warming may bring. Alterations to the regional climate could affect forests, crop yields, and water supplies as well as impact human health, animals, and various types of ecosystems. Currently, scientists are unable to determine which parts of the United States will become wetter or drier, but there is likely to be an overall trend toward increased precipitation and evaporation, more intense rainstorms, and drier soils.

The U.S. Environmental Protection Agency's (EPA's) WasteWise Program recognizes the importance of addressing global climate change and that waste prevention and recycling can play a significant role in reducing greenhouse gas emissions. Through WasteWise's Climate Campaign, EPA is helping companies reduce their climate footprints.

Waste Generation & Climate Change



Every stage of a product's life cycle impacts climate change. In addition, each stage requires the use of natural resources and the consumption of energy—human activities that result in the release of GHGs and impact the Earth's atmospheric balance.

- **Energy Consumption**—Manufacturing and using products requires energy. An increase in energy demand leads to the extraction, processing, delivery, and combustion of more fossil fuels and, therefore, the release of more GHGs into the atmosphere.
- **Raw Material Use**—Harvesting, extracting, and transporting raw materials releases GHGs. In addition, harvesting trees and other biomass decreases carbon storage, because plants absorb CO_2 from the atmosphere and store the carbon in their biomass.
- **Waste Disposal/Incineration**—Disposing of organic materials, such as food, paper, and yard trimmings, increases CH_4 levels during anaerobic waste decomposition (i.e., decomposition that occurs in landfills). Additionally, the collection, transportation, and processing of wastes releases GHG emissions.

Life Cycle Assessment

Cradle-to-Grave GHG Emissions

The term "life cycle" comprises all activities included in the product's lifetime—from manufacturing (including raw material extraction and processing), to use, maintenance, to disposal—also known as "cradle to grave." Companies can analyze a product's life cycle to determine where they can make changes (e.g., preventing waste, reducing quantities of materials used, reusing products, recycling, or using recycled-content materials in a product) to reduce climate impacts. Life cycle assessments (LCAs) evaluate environmental aspects and impacts associated with products, processes, or services.

History of LCAs

1969–1970—The initial life cycle methodology was carried out for The Coca-Cola Company on alternative materials for soft drink containers. It was the first life cycle study done worldwide. Early practitioners referred to the technique as Resource and Environmental Profile Analysis (REPA).

1970s—About 15 REPAs were carried out for various companies. These early studies were comprehensive but focused on solid waste generation and energy consumption.

Late 1970s–Early 1980s—REPAs in this time period focused mainly on energy consumption.

1990—A worldwide conference in Vermont supported by EPA established the concept of Life Cycle Assessment (LCA) in its broader context. The term Life Cycle Inventory (LCI) replaced REPA.

1990s–Present—LCA activity continues to increase. Focus shifted from competitive studies (e.g., paper versus plastic, reusable versus disposable) to environmental evaluation and improvement analysis. Emphasis now is on energy and GHGs. Both industry and government recognize LCA as a strong environmental analysis technique to reduce environmental burdens.

The following are components of an LCA:

- **Goal Setting/Scoping**—Define/describe the product system(s) to be analyzed. Identify the boundaries and environmental inputs and outputs to be reviewed.
- **Inventory Analysis**—Quantify energy and raw material requirements, air emissions, waterborne effluents, solid waste, and other environmental inputs and outputs step-by-step throughout the life cycle.
- **Impact Assessment**—Analyze the potential impacts on human and environmental health associated with the inputs and outputs identified during the inventory analysis.
- **Interpretation/Improvement Analysis**—Interpret the results of the analysis and assessment to identify opportunities for reducing environmental burdens and impacts. Improvement analysis can be conducted based on the results of the Inventory Analysis or the Impact Assessment.

Based on the gathered information, LCAs can uncover opportunities for manufacturers to:

- Produce goods using lesser quantities or fewer types of materials
- Decrease the energy use associated with extracting, transporting, and processing raw materials and transporting end products
- Update product designs
- Replace or redesign products
- Alter transportation methods
- Improve product use
- Enhance disposal methods

In addition, GHG reduction activities can have a beneficial effect on a company's bottom line, such as reductions in purchased energy or materials.

Life Cycle Resources

EPA's Life Cycle Assessment Web Site—This site promotes the use of LCA to make informed decisions based on the human health and environmental impacts of products, processes, and activities.

<www.epa.gov/ORD/NRMRL/lcaccess>

EPA's Design for the Environment Program's LCA Web Site—This site discusses the use of LCAs to examine the environmental impacts of products over their entire life cycle, from materials acquisition to manufacturing, use, and disposition.

<www.epa.gov/oppt/dfe/tools/lca.htm>

Life Cycle Inventory Database Project—The National Renewable Energy Laboratory and the Athena Sustainable Materials Institute are developing a U.S. LCI database to track the environmental burdens for commonly used materials, products, and processes. This database provides life cycle inventory data to support public, private, and nonprofit sector efforts to develop product life cycle assessments, support systems, and tools.

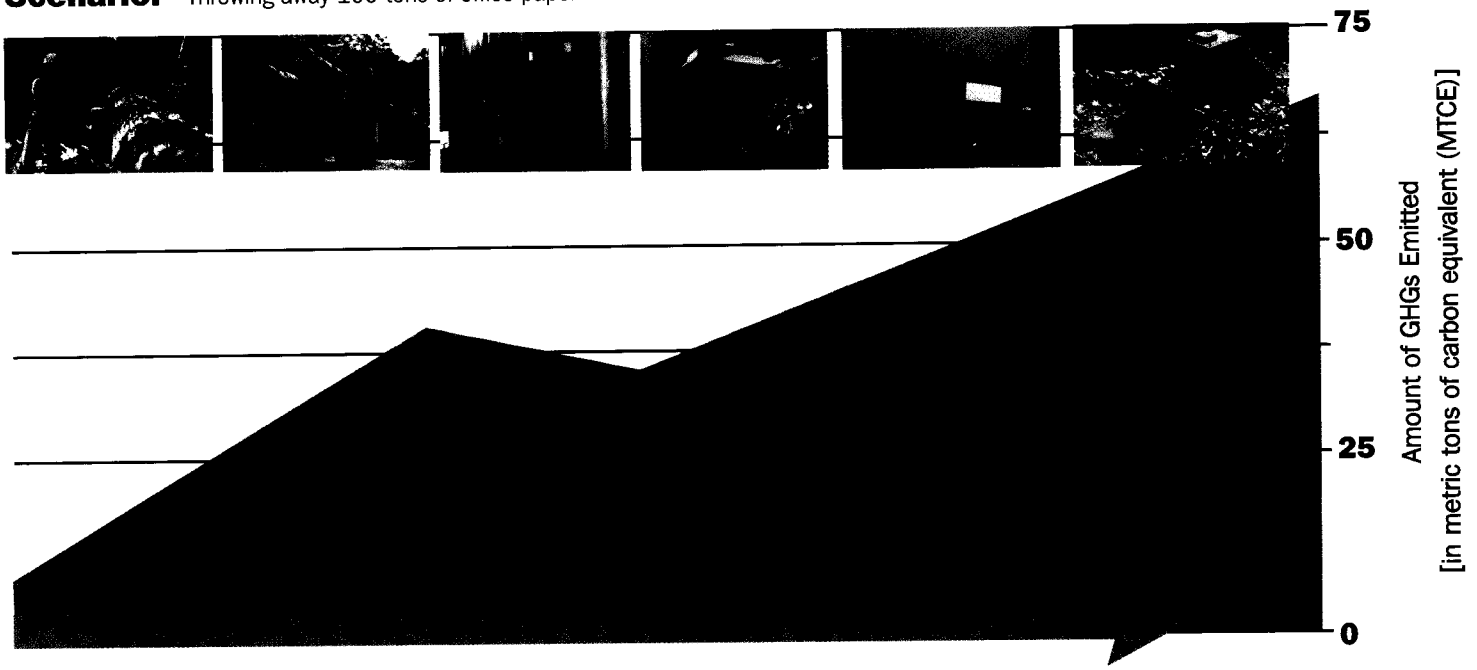
<www.nrel.gov/lci>

The American Center for Life Cycle Assessment Web Site—This organization was formed in 2001 to build capacity and knowledge of LCA.

<http://lcacenter.org>

The following is a sample product life cycle displaying where GHGs are emitted.

Scenario: Throwing away 100 tons of office paper

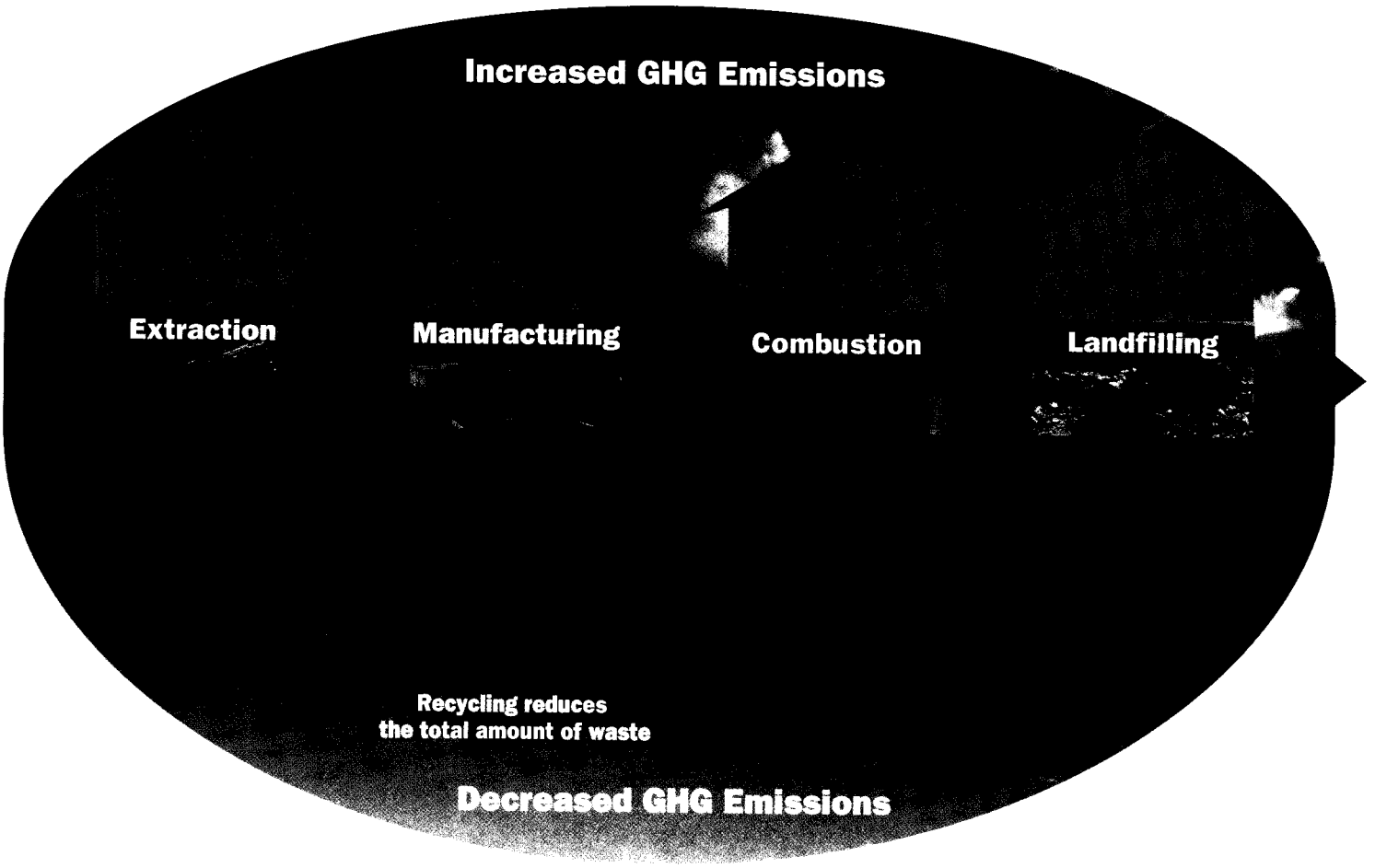


Waste Management Impact: 62 MTCE

Life Cycle Stages Provide Numerous Opportunities to Reduce GHG Emissions

Because GHGs are released during each stage of a product's life cycle, there are numerous opportunities for a company to decrease a product's contribution to climate change. Companies can reduce emissions associated with resource extraction, manufacturing, distribution, product use, combustion, or landfilling.

The Link Between Waste Management and Greenhouse Gases



Mitigating Climate Change

There are numerous opportunities for companies to mitigate their impact on climate change, regardless of whether they conduct a life cycle assessment. WasteWise was developed to promote reuse, donation, and recycling in addition to the manufacture and purchase of products containing recycled materials. To complement these efforts and further reduce GHG emissions, companies can implement various measures.

The Basics

There are countless basic waste reduction activities that companies can implement to reduce their climate impacts. A comprehensive list can be found online in WasteWise document, *Selected Goals of WasteWise Partners* (available to WasteWise partners only) at <www.ergweb.com/waste/private/pubs/goals.pdf>. Another useful resource for planning a waste reduction program is EPA's *Business Guide To Reducing Solid Waste* at <www.epa.gov/epaoswer/non-hw/muncpl/pubs/red2.pdf>. These documents can help companies manage endeavors that decrease demands on raw materials, decrease energy consumption, increase energy efficiency, and even save money.

But there are even more benefits of implementing such activities—companies should realize that such undertakings also decrease GHG emissions. By decreasing production waste or using materials with recycled content, companies can decrease their demand on raw materials—therefore, decreasing GHG emissions from curtailing the need for harvesting, transporting, and manufacturing raw materials. Companies can also decrease energy consumption and improve energy efficiency by making processes more efficient and regularly maintaining equipment—therefore, decreasing GHG emissions by lessening the demand on the exploring, extracting, gathering, processing, distributing, and transmitting natural resources required to produce energy.

Below is a listing of a few activities and Internet links for further information.

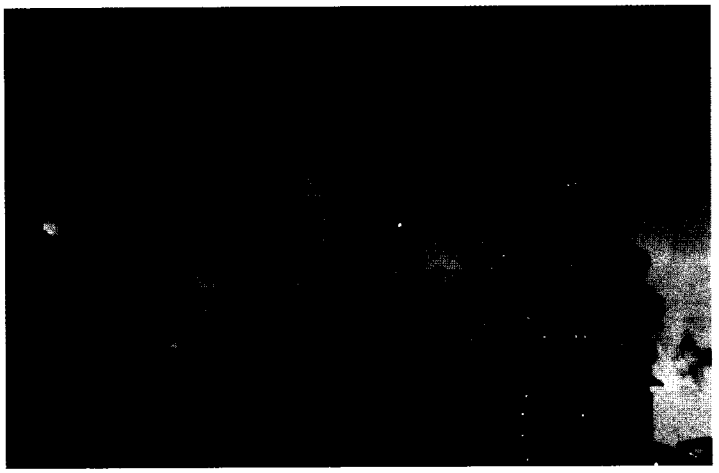
- **Implement waste reduction practices: reuse/donate, compost, recycle, use recycled-content products**
  EPA's WasteWise program, <www.epa.gov/wastewise>
- **Reduce raw material usage**
  WasteWise Tip Sheet: Buying or Manufacturing Recycled Products, <www.epa.gov/wastewise/pubs/buy.pdf>
- **Improve/optimize manufacturing processes**
  The Pew Center on Global Climate Change, <www.pewclimate.org/what_s_being_done/in_the_business_community/processimprovements.cfm>
- **Improve material specification standards**
  EPA's Comprehensive Procurement Guidelines Web site, <www.epa.gov/cpg>
- **Sell byproducts and scraps for reuse**
  The Buy Recycled Business Alliance, <www.nrc-recycle.org/brba>
- **Increase energy efficiency**
  EPA's ENERGY STAR® program, <www.energystar.gov>
- **Improve operation and maintenance programs**
  The Practical Steps: Products and Processes section of the Global Environmental Management Initiative Business and Climate Change Web site, <www.businessandclimate.org>

Climate Change How-To Guide

Climate Change Factoids

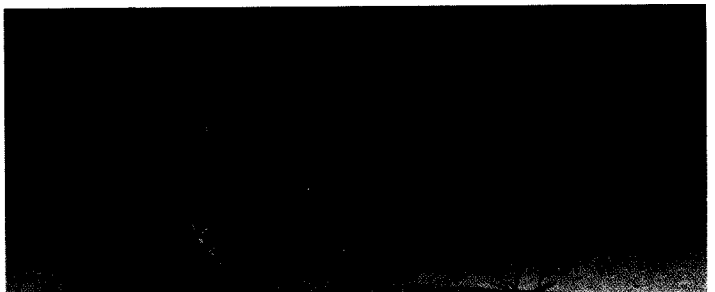
The following quotes are from a recent article titled "Global Warming," which was written by John Carey and Sarah Shapiro and appeared in the August 16, 2004 edition of *BusinessWeek*.

"Some changes in the climate system, plausible beyond the 21st century, would be effectively irreversible."



"There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities."

"Overall, climate change is projected to increase threats to human health, particularly in lower income populations, predominantly within tropical/subtropical countries."



"Human activities have increased the atmospheric concentrations of greenhouse gases and aerosols since the pre-industrial era."

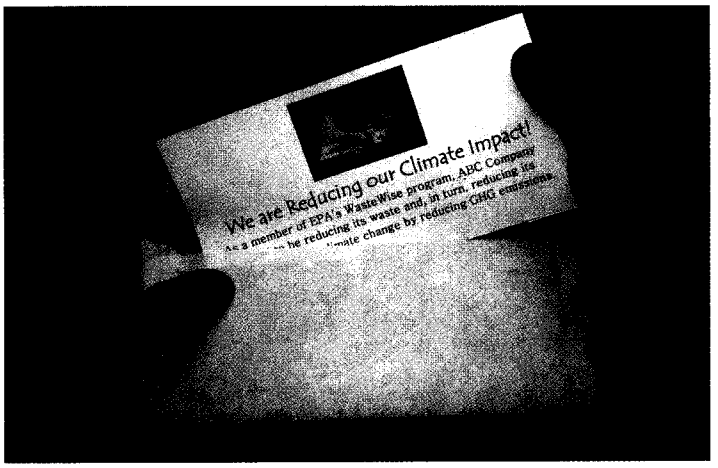
"Projections using the SRES [Special Report on Emissions Scenarios] emissions scenarios in a range of climate models result in an increase in globally averaged surface temperature of 1.4° to 5.8°C over the period 1990 to 2100. This is about two to 10 times larger than the central value of observed warming over the 20th century, and the projected rate of warming is very likely to be without precedent during at least the last 10,000 years, based on paleoclimate data."

"It's increasingly clear that even the modest warming today is having large effects on ecosystems. The most compelling impact is the 10% decreasing yield of corn in the Midwest per degree [of warming]."

—Christopher B. Field, Carnegie Institution ecologist

"The facts are there. We have to educate our fellow citizens about climate change and the danger it poses to the world."

—Senator John McCain (R-AZ)

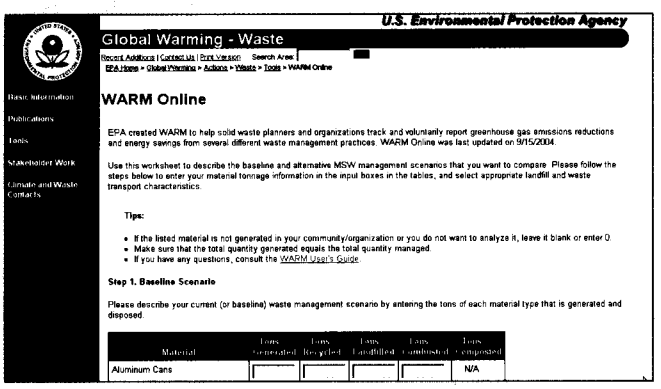


Climate–Waste Tools

To help WasteWise partners calculate GHG emissions reductions from their waste reduction efforts, WasteWise developed numerous resources. These state-of-the-art tools allow companies to easily share GHG emissions reduction successes with employees, stakeholders, the general public, and other interested parties.

WARM

EPA's WAste Reduction Model (also known as WARM) is a tool that calculates and totals GHG emissions related to solid waste management practices (i.e., source reduction, recycling, combustion, composting, and landfilling). WARM can help companies track and voluntarily report GHG emissions reductions. The model calculates GHG emissions in MTCE, $MTCO_2E$, and energy units (million BTU) for a wide range of material types commonly found in municipal solid waste.



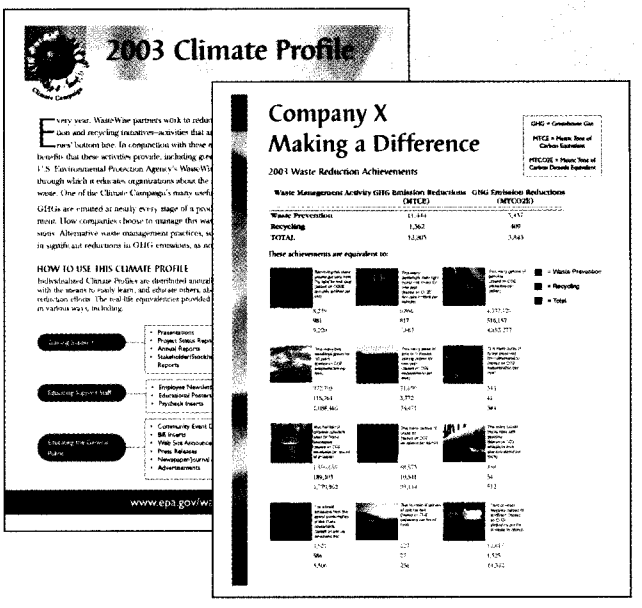
EPA's WARM Spreadsheet

EPA regularly updates WARM to reflect revised energy and fuel mix inputs associated with waste reduction efforts. EPA is also working to analyze additional materials and add them to the model.

WARM is available online and as a downloadable Microsoft Excel spreadsheet at<http://yosemite.epa.gov/oar/globalwarming.nsf/content/ActionsWasteWARM.html>.

WasteWise's Climate Profile

The Climate Profile is a new tool that WasteWise provides its partners to describe GHG emissions reductions resulting from their individual waste prevention and recycling activities. It analyzes waste reduction data, displays trends, and reports emissions reductions in real-life equivalents. The Climate Profile consists of a summary of GHG emissions reductions, a three-year trend for waste prevention and recycling activities, a breakdown of GHG



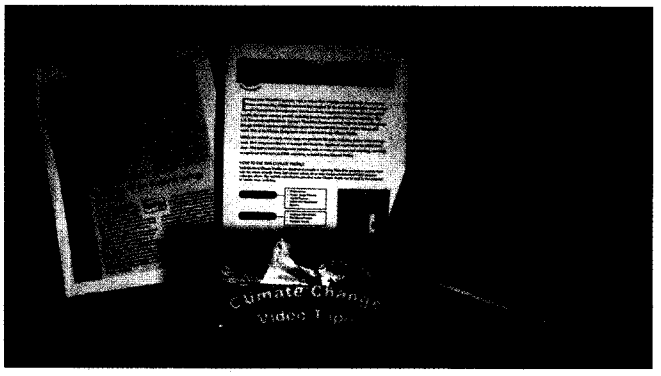
The WasteWise Climate Campaign's Climate Profile

emissions reductions by major commodities, and GHG equivalent factors (i.e., the number of cars removed from the road for one year, the number of acres of trees storing an equal amount of carbon, and the number of households emitting an equal amount of GHGs through power consumption).

The Climate Profile is a benefit that all reporting WasteWise partners receive on an annual basis.

Climate Change Toolkit

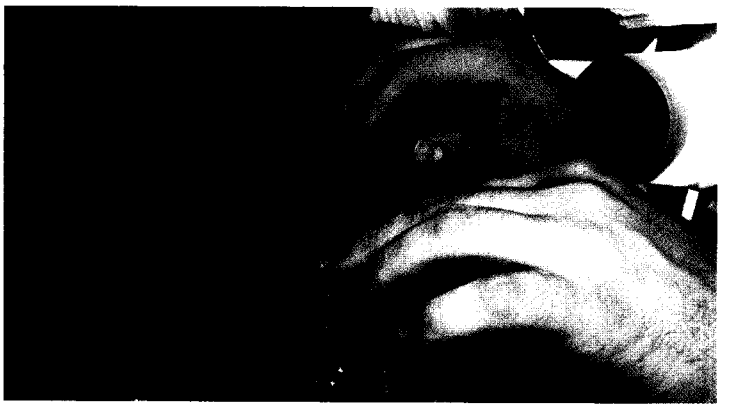
The latest information on the climate-waste connection is located in WasteWise's Climate Change Toolkit—available



WasteWise Campaign's Climate Profile

exclusively to WasteWise partners. The Climate Change Toolkit contains the WasteWise program's best climate tools, including: the "Why Waste A Cool Planet" video the *WasteWise Update: Global Warming Is a Waste*, an issue of the *WasteWise Bulletin* on climate, numerous climate case studies, the Climate Change and Waste resources folder, a sample press release, and two magazine articles.

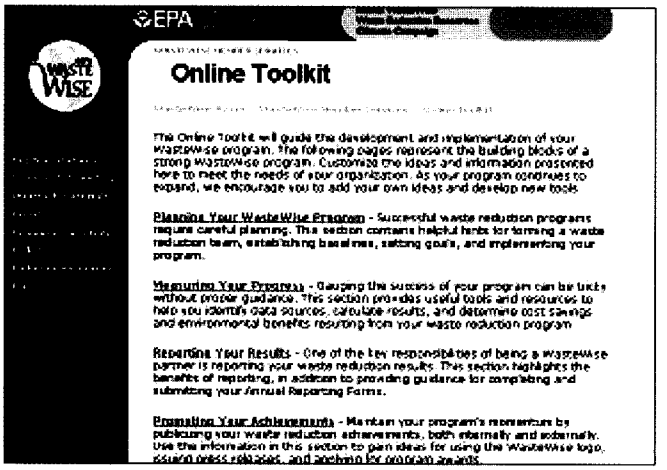
The Climate Change Toolkit is available to WasteWise partners. To order the toolkit, please contact the WasteWise Helpline at (800) EPA-WISE or <ww@erg.com>.



WasteWise Online Toolkit

Quantifying waste prevention results is one of the most challenging aspects of any waste reduction program. To help WasteWise partners assess their achievements EPA developed the Online Toolkit. In addition to helping companies set up a waste reduction program, the toolkit provides resources to help partners locate data sources, calculate waste reduction results, and determine the environmental and economic benefits of their waste reduction programs.

The Online Toolkit is available to WasteWise partners in the Member Services section of the WasteWise Web site at <www.ergweb.com/waste/private/toolkit.htm>.



For WasteWise Partners Only—
www.ergweb.com/waste/private/toolkit.htm

How To Get Involved

In recent years, WasteWise has become a leader in highlighting companies that tangibly and cost-effectively reduce GHG emissions—helping companies gain recognition for ongoing environmental successes. WasteWise encourages companies of all types to support the WasteWise Climate Campaign and take advantage of WasteWise's new Climate Change award and other acknowledgment opportunities.

For more information on WasteWise's Climate Campaign, visit <www.epa.gov/wastewise/climate>.

Do you want to get involved with the WasteWise Climate Campaign? Do you want to share your climate change success stories with EPA?

If you would like more information about the Climate Campaign and recognition opportunities, contact Jan Canterbury at <canterbury.janice@epa.gov> or (703) 308-7264.

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